92-76

LEOAC-0 (Rev.2)

List of Documents

LEOAC-0	(Rev.1) List of Documents
LEOAC-1	Public Notice "Below 1 GHz Negotiated Rulemaking Committee"
LEOAC-2	(Rev.1) Work Program - Below 1 GHz LEO Negotiated Rulemaking Committee
LEOAC-3	VITA's application - File No. ***
LEOAC-4	ORBCOMM's application - File No. 22-DSS-P-90(22)
LEOAC-5	Amendment to ORBCOMM application
LEOAC-6	STARSYS's application - File No. 33-DSS-P-90(26)
LEOAC-7	LEOSAT's application - File No. 12-DSS-P-91(2)
LEOAC-8	List of IFRB Publications
LEOAC-9	Federal Use of the 148-149.9 MHz band
LEOAC-10	Extract from "DOC's Spectrum Sharing Study Phase 2 (Final Report)"
LEOAC-11	CCIR Doc. 8D/TEMP/13 "Method for Determining Sharing between Stations in the Mobile Service below 1 GHz and FDMA Non-GSO Mobile Earth Stations"
LEOAC-12	CCIR Doc. 8D/TEMP/36 "Methods for Analyzing Sharing between existing Fixed and Mobile and Meteorological Systems and Spread-Spectrum CDMA LEO MSS below 1 GHz"
LEOAC-13	Charter for the Below 1 GHz LEO Negotiated Rulemaking Committee
LEOAC-14	"Jointly Filed Comments of ORBCOMM, STARSYS and VITA" CC Docket No. 92-76, dated May 18, 1992 Addendum 1 - Identification of technical service proposals
LEOAC-15	"Jointly Filed Supplemental Comments of ORBCOMM, STARSYS and VITA", CC Docket No. 92-76, dated August 7, 1992 Addendum 1 - Graph, Uplink Band Addendum 2 - LEO Possible Sharing Scenario (ORBCOMM, STARSYS & VITA) Addendum 3 - Graph, Downlink Channelization Plan
LEOAC-16	LEOSAT Reply Comments dated May 29, 1992
LEOAC-17	Notice of Proposed Rule Making, ET Docket No. 91-280
LEOAC-18	Extracts from Final Acts of the World Administrative Radio Conference (WARC-92), Addendum + Corrigendum to the Final Acts and from the Radio Regulations
LEOAC-19	Chapter 10, NTIA Regulations
LEOAC-20	Part 25, FCC Regulations
LEOAC-21	Public Notice dated August 4, 1992
LEOAC-22	FAA's Letter of August 14, 1992 re: VHF AM(R)S
LEOAC-23	CCIR Report (Excerpts) "Technical and Operational Bases for WARC-92
LEOAC-24	Reply Comments of ORBCOMM, ET Docket No.91-280 dated January 23, 1992
LEOAC-25	Possible STARSYS Earth Station Locations
LEOAC-26	Comments of STARSYS, ET Docket No.91-280 dated December 24, 1991
LEOAC-27	IWG draft language, §§25.401, 25.407
LEOAC-28	IWG draft language, §§25.202(f) and (g), 25.203
LEOAC-29	Public Notice dated August 14, 1992
LEOAC-30	Comments of LEOSAT, ET Docket 91-280 dated December 24, 1991

LEOAC-2 (Rev.1)

WORK PROGRAM

BELOW 1 GHz LEO NEGOTIATED RULEMAKING COMMITTEE

Develop recommendations for FCC Rules in CFR 25 that address the technical aspects related to selection and authorization of applicants to provide mobile satellite service in the frequency bands 137- 138 MHz and 400.15 - 401 MHz (space to Earth) and 148- 149.9 MHz (Earth to space) and potentially 149.9-150.05 MHz (Earth to space).

A. Any recommendation should consider the potential sharing with the existing environment in each of the frequency bands. The rules should address:

1.) sharing with terrestrial services operating in the bands in the U.S. and other countries, i.e., Canada and Mexico; particularly the viability of the LEO satellite systems to operate in the presence of the existing terrestrial environment.

2.) the coordination of and the ability of non-geostationary mobile satellite system to operate within the same frequency band with:

a.) other U.S. non-Geostationary mobile satellite systems;

b.) Non-U.S. non-Geostationary mobile satellite systems;

3.) coordination of MSS satellite systems with other space services operating in the same frequency bands, including:

a.) Meteorological satellite

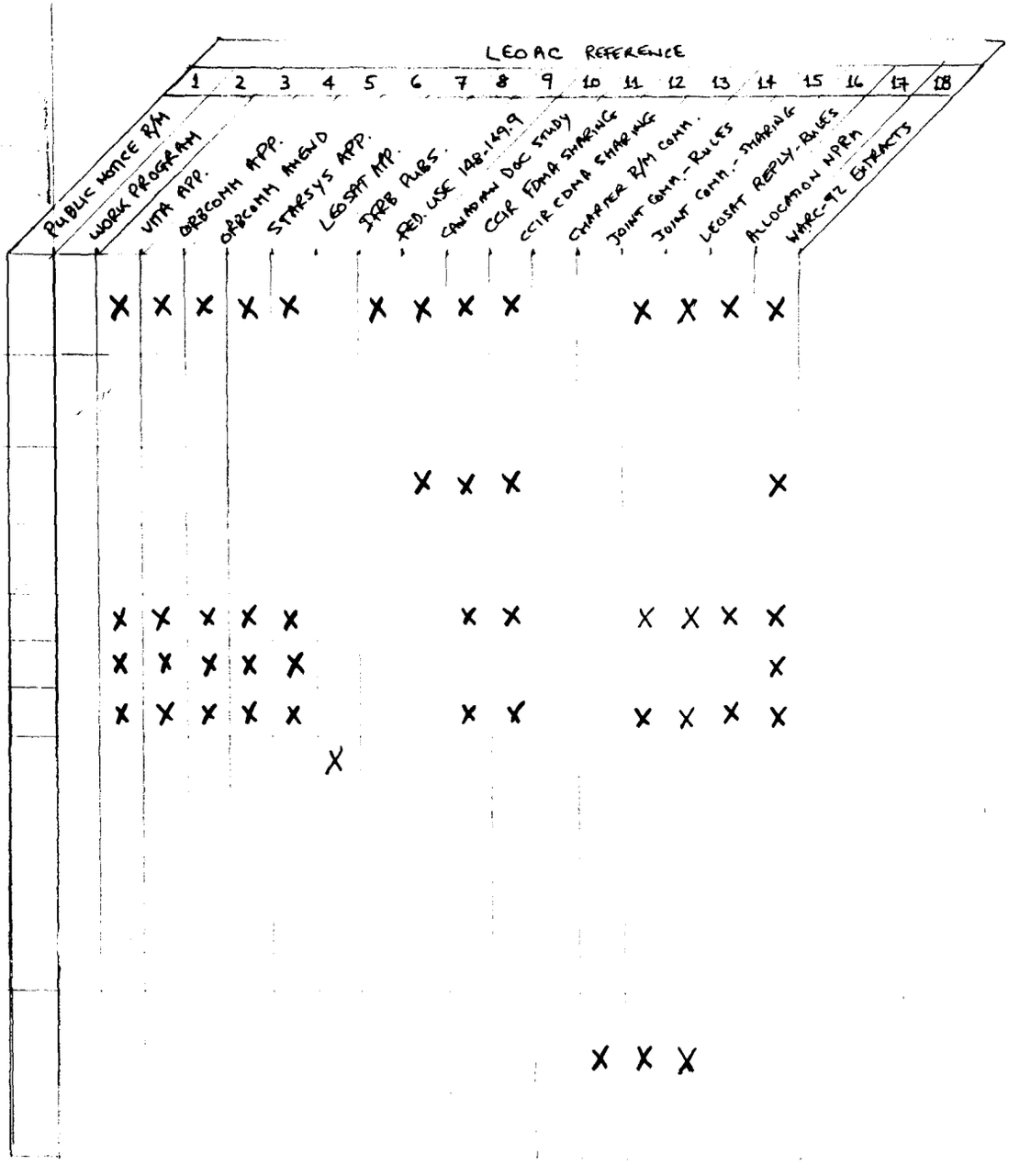
b.) Space Research

c.) Space operation

d.) Radionavigation satellite

e.) Other

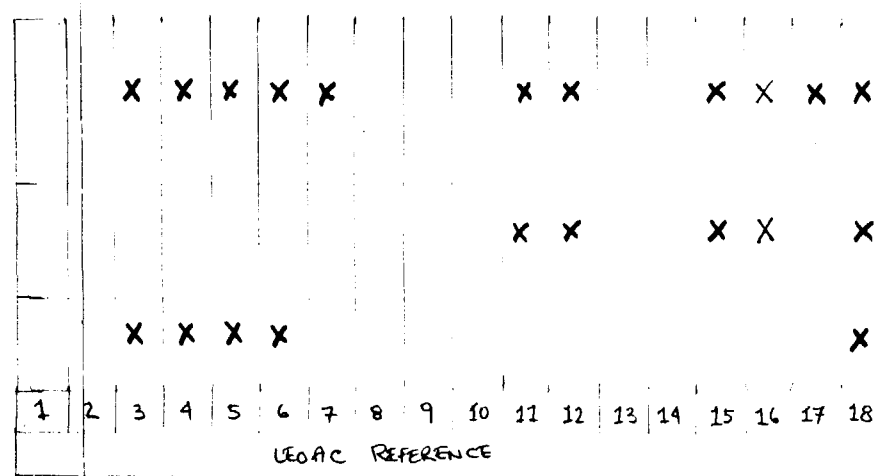
B. Since there are other existing space and terrestrial radio services operating in the proposed frequency bands and the total spectrum demand of all the applications appears to exceed the spectrum allocated, recommend rules to promote multiple entry and to avoid mutual exclusivity among the applicants while maintaining the economic viability of the systems. If rules cannot be developed to avoid mutual exclusivity and to accommodate all the applications before the FCC or to be submitted in any subsequent round of submissions, recommend technical rules necessary to select and authorize specific applicants among the competing mutual exclusive applications.



C. In light of the fact that these applications are proposing to use these bands for feeder links from the base stations as well as the service links to and from the mobile units, is there any need for and if so propose, technical rules to differentiate base stations from mobile units. For example, is it necessary to segment the band for FDMA systems for base stations and mobile stations or to reduce the return link power density for CDMA systems?

D. Recommend rules on power density etc., to comply with the international Radio Regulations (599A, 608X, 608Y, 647X) recognizing that these technical constraints are under study within the CCIR.

E. Recommend rules for any out of band emission requirements to protect adjacent band services and operations.



CHARTER FOR THE BELOW 1 GHz LEO NEGOTIATED RULEMAKING COMMITTEE

A. The Committee's Official Designation

The official designation of the advisory committee will be the "Below 1 GHz LEO Negotiated Rulemaking Committee."

B. The Committee's Objective and Scope of its Activity

The purpose of the committee is to provide recommendations to the Federal Communications Commission to be used in the formulation of technical rules governing the provision of low-Earth orbit satellite services operating below 1 GHz (little LEOs). The committee will also assist the FCC in resolving questions relating 1) to the maximum sharing of available frequencies for low-Earth orbit services, and 2) to coordination of little LEO services with existing and future terrestrial and/or satellite services, domestically and internationally. The scope of the activity of the committee will include all steps necessary to assemble data, perform analyses and provide advice to the FCC concerning the technical, licensing and coordination issues presented by this new satellite service.

C. Period of Time Necessary for the Committee to Carry Out Its Purpose

The committee will require 37 days to carry out its purpose.

D. Official to Whom the Committee Reports

Chief, Common Carrier Bureau, Federal Communications Commission.

E. Agency Responsible for Providing Necessary Support

The Federal Communications Commission will provide the necessary support for the committee, including facilities needed for the conduct of the meetings of the committee. Private sector members of the committee will serve without any government compensation, nor will they be entitled to travel expenses or per diem subsistence allowances.

F. Description of the Duties for Which the Committee is Responsible

The duties of the committee will be to gather and discuss information necessary to form recommendations to the FCC for the regulation, licensing and coordination of little LEO satellite services.

G. Estimated Operating Costs in Dollars and Staff Years

Estimated staff years that will be expended by the committee are .04 for the FCC staff and .2 for the private sector and other governmental representatives. The estimated cost to the FCC of operating the committee is $3,000.

H. Estimated Number and Frequency of Committee Meetings

We expect that there will be 6 meetings, with possibly more meetings of informal subcommittees.

I. Committee's Termination Date

The committee will terminate September 16, 1992.

J. Date Original Charter Filed

August 10, 1992.

LEOAC-14
(Ada. 1)

Leoac #14 Sections
Having
Technical Aspects

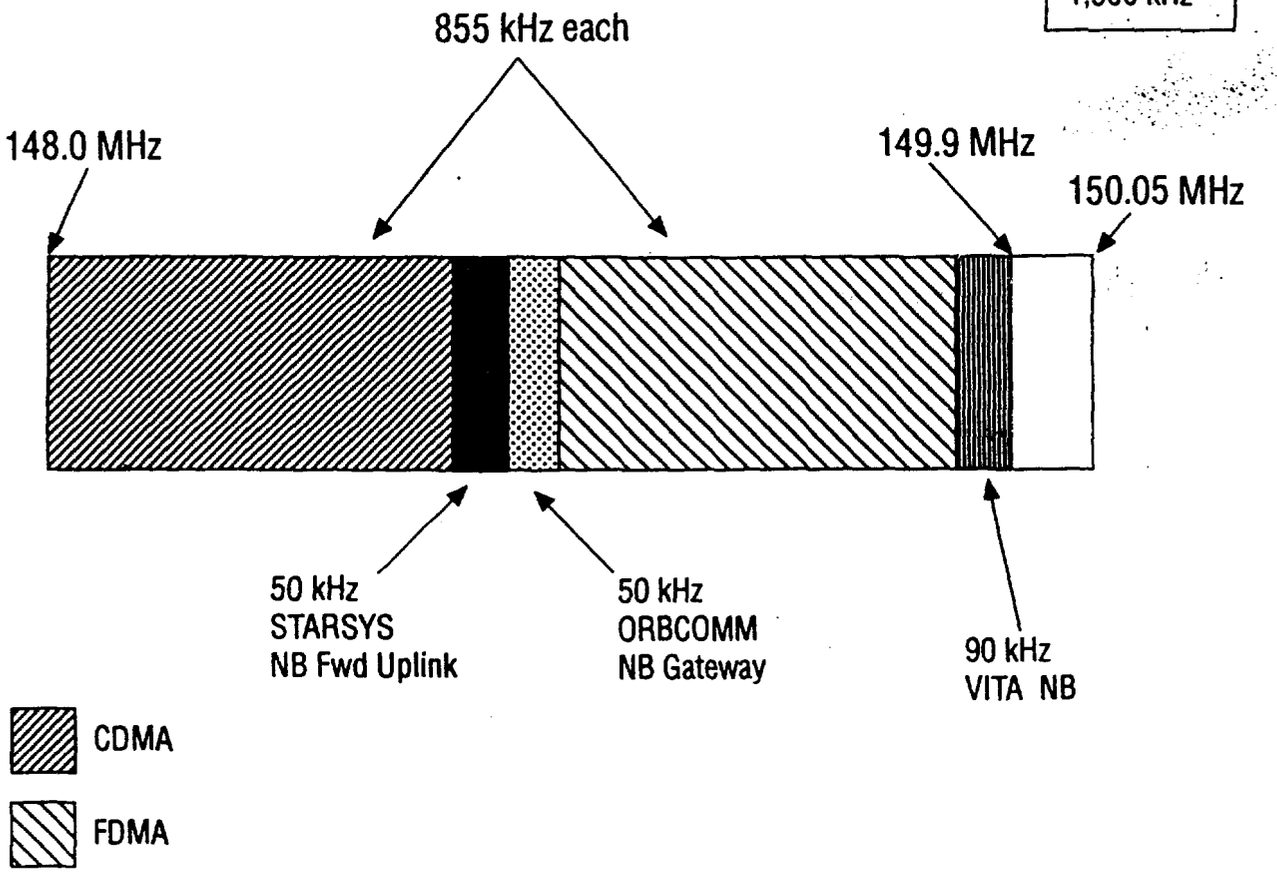
Page 1 - Section 2. Add new Subsection (27) to section 25.114(c)

Page 1 - Section 3 Modify 25 to add Subpart F

25.401
25.407
25.408
25.409

LEOAC-15
(Add. 1)

855 kHz
855 kHz
50 kHz
90 kHz
50 kHz
1,900 kHz

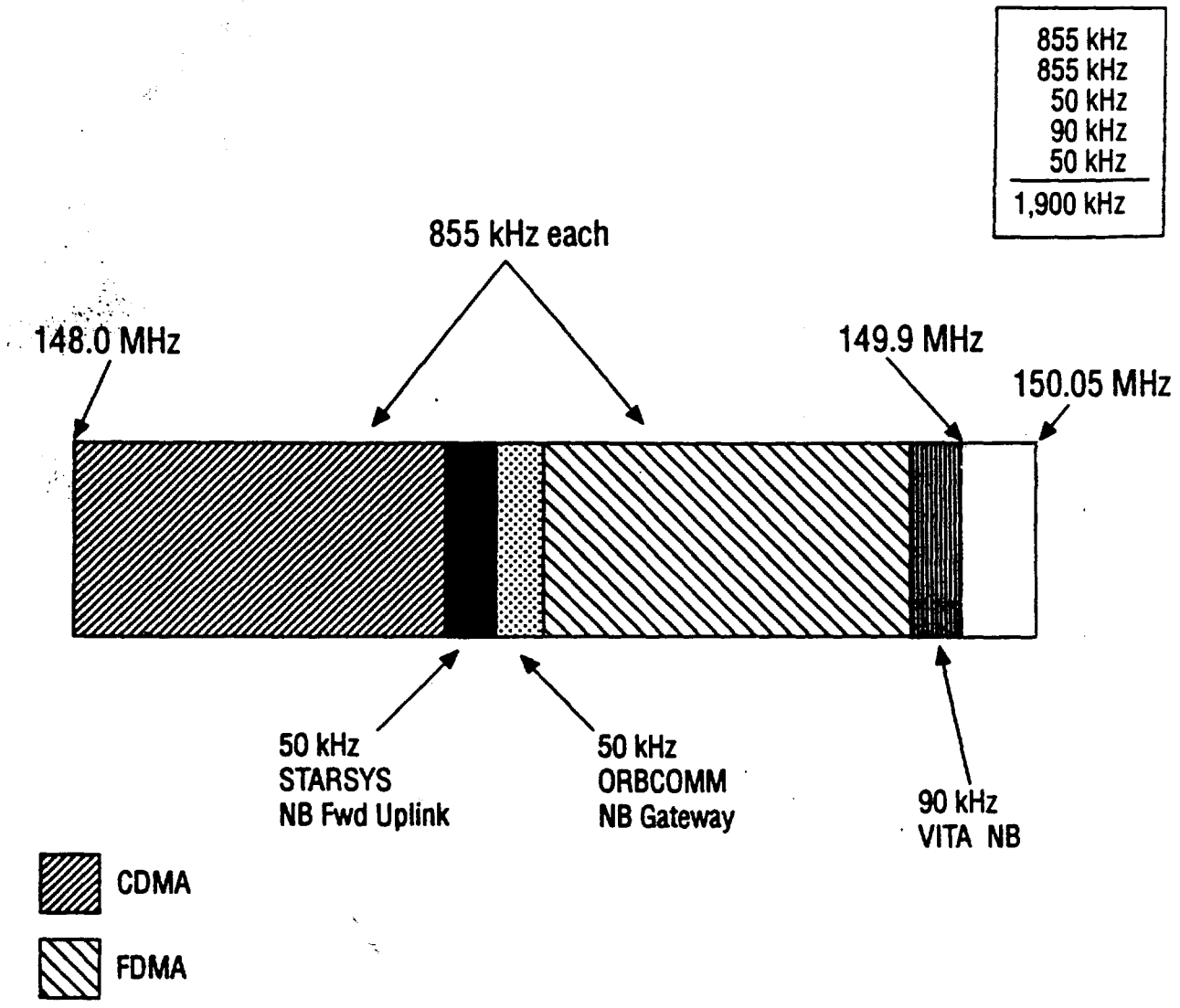


Uplink Band

Work Folder (peon)
Starsys fig. 2
jmf 8/5/02

LEOAC-15
(Add. 2)

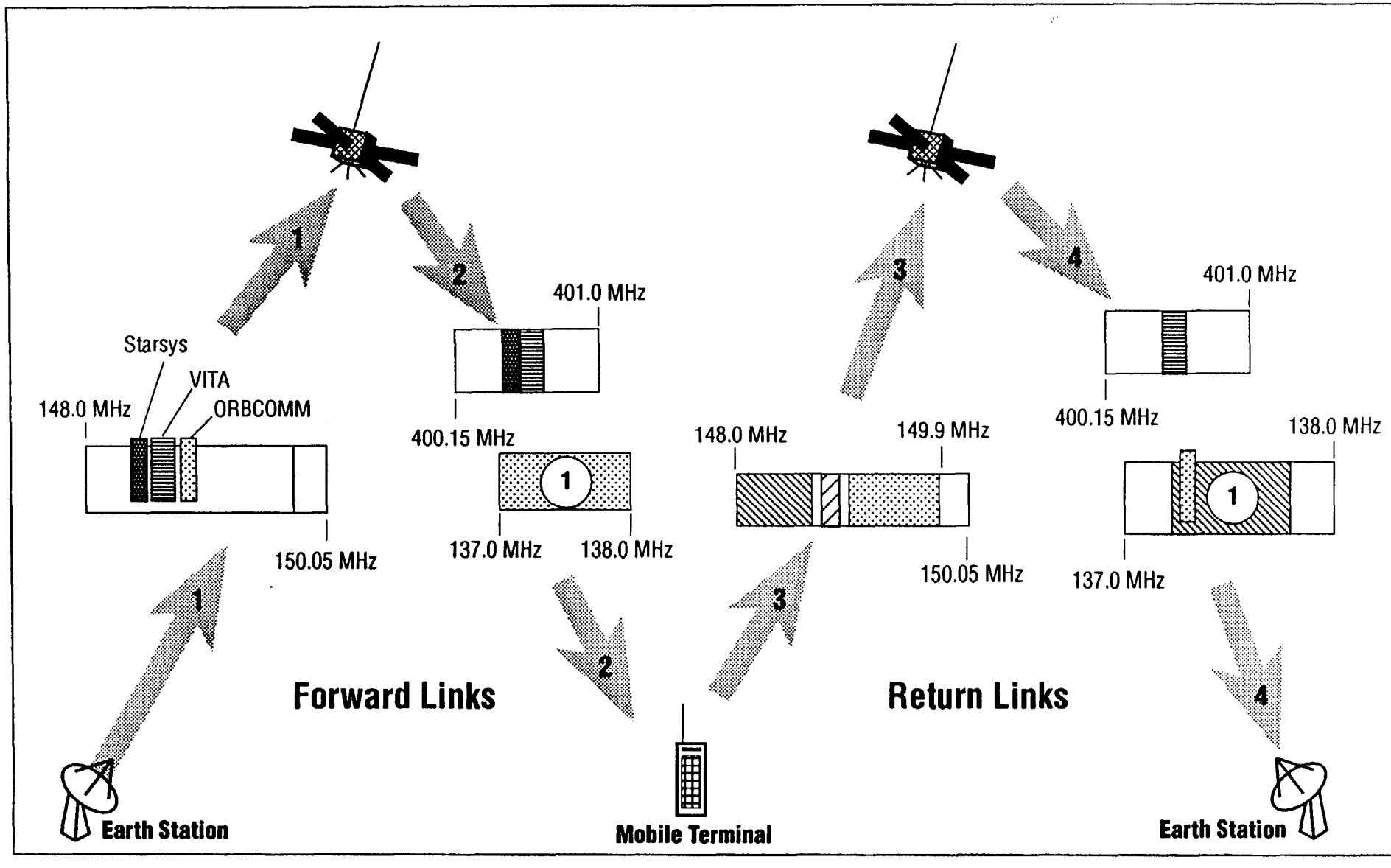
LEO
POSSIBLE SHARING SCENARIOS



Uplink Band

Work Folder (pcce)
Starsys fig. 2
jmf 6/5/02

LEO MSS < 1 GHz System Links



STARSYS CDMA

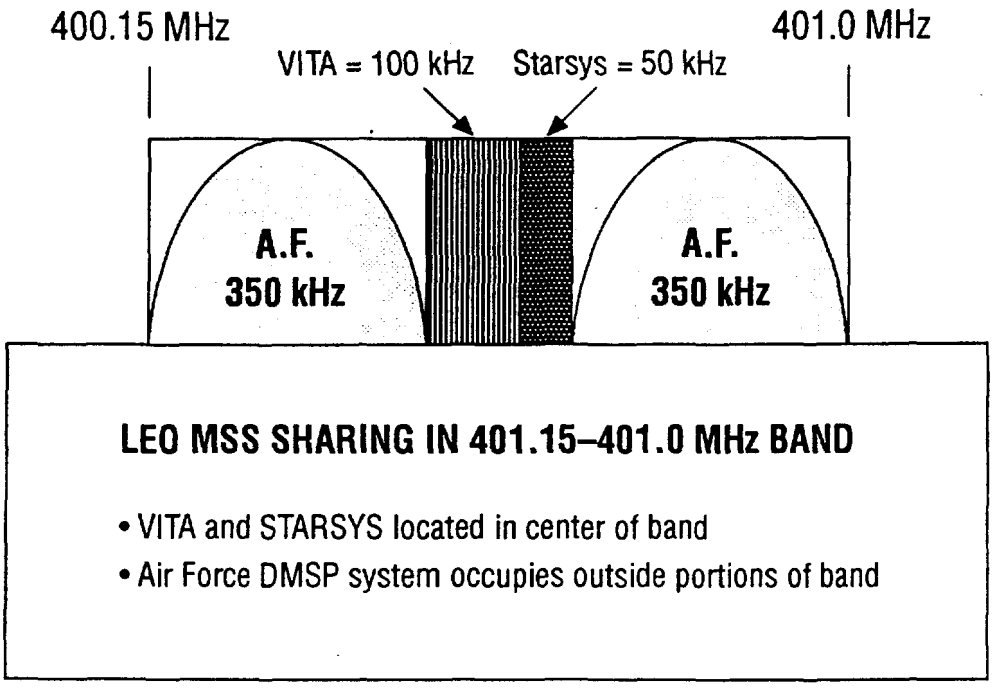
ORBCOMM FDMA

1 See downlink detail

STARSYS FDMA

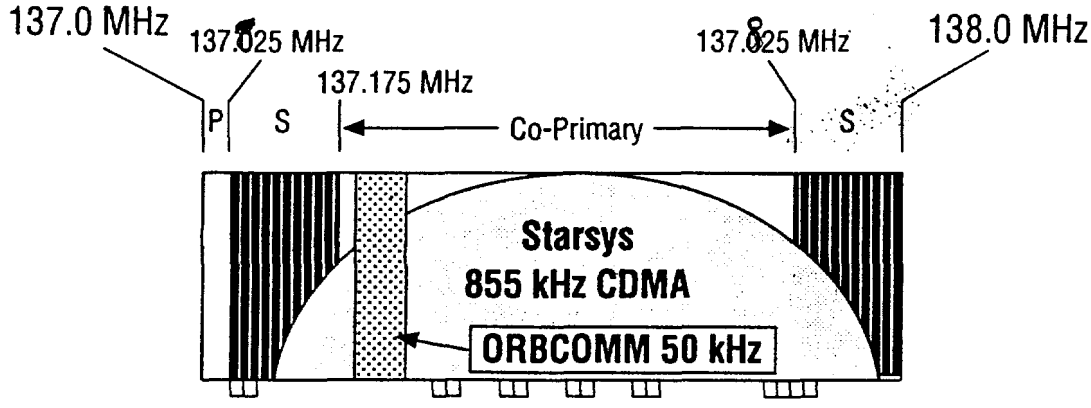
VITA FDMA Band (90 or 100 kHz)

Work Folder (peon)
Starsys Fig. 4
jmi 8/5/92



LEO MSS SHARING IN 401.15–401.0 MHz BAND

- VITA and STARSYS located in center of band
- Air Force DMSP system occupies outside portions of band



LEO MSS SHARING IN 137.0–138.0 MHz BAND

- STARSYS/ORBCOMM sharing via directional antennas and cross-polarization
- STARSYS spread spectrum limited to 855 kHz due to uplink width

P = Primary

S = Secondary

= Existing METSAT channel

Downlink Band

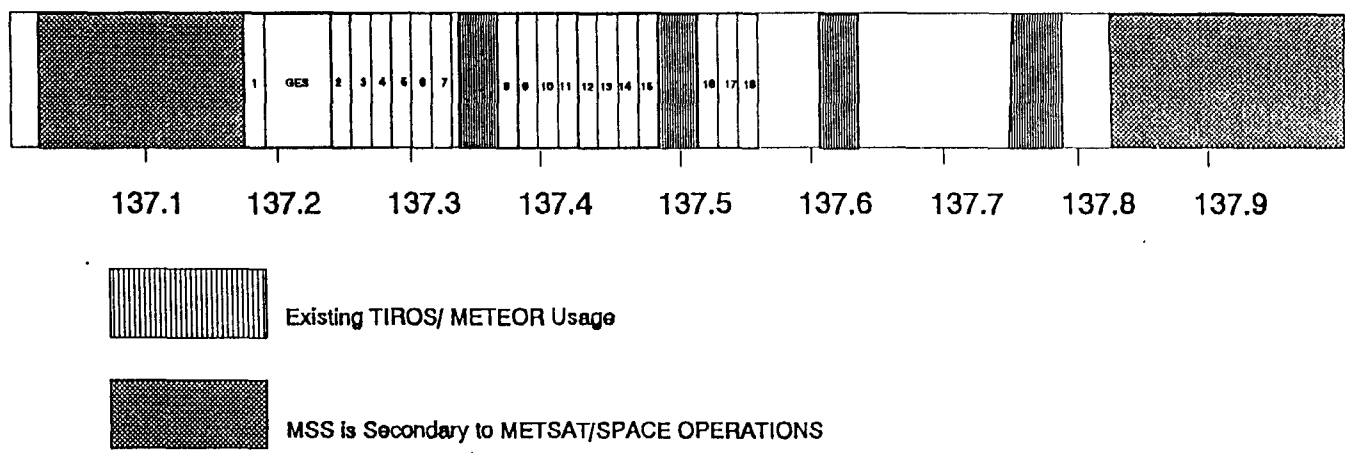
Work Folder (peon)
Starsys fig. 3
jmf 8/5/92

LEOAC-15 (Add. 3)

ORBCOMM Downlink Channelization Plan

Orbital Communications Corporation

An OSC Company



CHAPTER 10

Procedures for the Review of Telecommunication Systems for Frequency Availability and Electromagnetic Compatibility (EMC)

10.0 GENERAL

10.0.1 Avoiding Interference

Government agencies planning the use of, conducting experiments relating to, or developing and procuring telecommunication systems requiring the use of radio frequencies shall take all reasonable measures to ensure that such systems will neither cause nor receive harmful interference to or from other authorized users when placed in their intended operational environments. In planning telecommunication systems within the scope of this procedure, Government agencies shall develop systems for operational use in accordance with the applicable portions of the National Tables of Frequency Allocations and the provisions of this Manual, unless an exception is recommended by the Spectrum Planning Subcommittee (SPS) and approved by NTIA.

10.0.2 Satisfying OMB Circular A-11

OMB Circular No. A-11 specifies in Section 12.4: "Estimates for the development or procurement of major communication-electronics systems (including all systems employing satellite (space) techniques) will be submitted only after certification by the National Telecommunications and Information Administration, Department of Commerce, the radio frequency required for such systems is available." NTIA certification of spectrum support can be obtained using the procedures in this chapter. The matter of preparation and submission to OMB of budget estimates for Government systems is covered in Section 8.2.5.

10.0.3 SPS Review of New Systems

To assist Government agencies in meeting the above responsibilities and to support the NTIA and the IRAC in the management of radio spectrum resources for the satisfaction of Government requirements, and in the national interest, these procedures provide for the review of certain new Government telecommunication systems and subsystems by the SPS, at a number of the stages of their evolution, prior to the assignment of frequencies. Such review will, as appropriate, require an examination of the existing systems in the frequency band(s) being considered.

10.0.4 FCC Participation

Full participation of the FCC in these procedures, for the review of Government systems intended for operation in bands of mutual Government/non-Government interest, occurs through the normal FCC liaison representation on the IRAC and its subcommittees.

10.0.5 War Emergency Conflicts

As part of its review, the SPS will identify those systems which may have EMC conflicts within the US&P during war emergency situations.

10.1 DEFINITIONS

10.1.1 Telecommunication System

A telecommunication system, for the purpose of this procedure, is a combination of facilities, stations, or circuits intended to perform an information transfer function by the use of the radio spectrum, e.g.:

-- a space station and its associated earth stations for provision of meteorological information;

-- a combination of aeronautical stations for communication support of air traffic control;

-- an interconnected network of fixed stations;

-- a combination of fixed and land mobile stations intended to provide communication support for law enforcement or protection activi-

(ii) Complaints alleging employment discrimination against a common carrier licensee of permittee who does not fall under the jurisdiction of the EEOC but is covered by appropriate enforceable State law, to which penalties apply, may be submitted by the Commission to the respective State agency.

(iii) Complaints alleging employment discrimination against a common carrier licensee or permittee who does not fall under the jurisdiction of the EEOC or an appropriate State law, will be accorded appropriate treatment by the FCC.

(iv) The Commission will consult with the EEOC on all matters relating to the evaluation and determination of compliance by the common carrier licensees or permittees with the principles of equal employment as set forth herein.

(2) Complaints indicating a general pattern of disregard of equal employment practices which are received against a licensee or permittee who is required to file an employment report to the Commission under § 1.815(a) of this chapter will be investigated by the Commission.

(f) *Records available to public*—(1) *Commission records.* A copy of every annual employment report, equal employment opportunity program, and reports on complaints regarding violation of equal employment provisions of Federal, State, Territorial, or local law, and copies of all exhibits, letters, and other documents filed as part thereof, all amendments thereto, all correspondence between the permittee or licensee and the Commission pertaining to the reports after they have been filed and all documents incorporated therein by reference, are open for public inspection at the offices of the Commission.

(2) *Records to be maintained locally for public inspection by licensees or permittees*—(i) *Records to be maintained.* Each licensee or permittee required to file annual employment reports, equal employment opportunity programs, and annual reports on complaints regarding violations of equal employment provisions of Federal, State, Territorial, or local law shall maintain for public inspection, in the same manner and in the same locations as required for the keeping and posting of tariffs as set forth in § 61.72 of this chapter, a file containing a copy of each such report and copies of all exhibits, letters, and other documents filed as part thereto, all correspondence between the permittee or licensee and the Commission pertaining to the reports after they have been filed and all documents incorporated therein by reference.

(ii) *Period of retention.* The documents specified in paragraph (f)(2)(i) of this section shall be maintained for a period of 2 years.

[35 FR 12894, Aug. 14, 1970, as amended at 36 FR 3119, Feb. 18, 1971. Redesignated at 38 FR 22481, Aug. 21, 1973]

PART 25—SATELLITE COMMUNICATIONS

Subpart A—General

Subpart B—Applications and Licenses

EARTH STATIONS

LEOAC-21

PUBLIC NOTICE

FEDERAL COMMUNICATIONS COMMISSION
1919 M STREET N.W.
WASHINGTON, D.C. 20554

24248

News media information 202/632-5050. Recorded listing of releases and texts 202/632-0002.

August 4, 1992

Below 1 GHz LEO Negotiated Rulemaking Committee

Agency: Federal Communications Commission

Action: Notice of public meetings.

Summary: In accordance with the Federal Advisory Committee Act, Public Law 92-463, as amended, this notice advises interested persons of the second and third meetings of the Below 1 GHz LEO Negotiated Rulemaking Committee ("Committee"), which will be held at the Federal Communications Commission in Washington, D.C.

Dates: August 18, 1992 at 9:30 a.m.
August 24, 1992 at 9:30 a.m.

Address: Federal Communications Commission, Rm. 856, 1919 M Street, N.W., Washington, D.C. 20554.

Supplementary Information: The agenda for the second meeting of the Committee is as follows.

1. Approval of agenda
2. Opening remarks
3. Report on progress of informal working groups
4. Discussion of informal working group reports
5. Discussion of additional/revised tasks, if any, for informal working groups
6. Update agenda for next meeting
7. Other business

A more detailed agenda for this meeting will be available at the Federal Communications Commission in CC Docket 92-76 following the Committee's first meeting on August 10, 1992.

(over)

The agenda for the third meeting of the Committee is as follows.

1. Approval of agenda
2. Opening remarks
3. Report on progress of informal working groups
4. Discussion of informal working group reports
5. Discussion of additional/revised tasks, if any, for informal working groups
6. Formation of informal editorial working group to prepare the Committee's report to the Federal Communications Commission
7. Agenda for the next meeting
8. Other business

A more detailed agenda for this meeting will be available at the Federal Communications Commission in CC Docket 92-76 following the Committee's second meeting on August 18, 1992.

Members of the general public may attend these meetings. The Federal Communications Commission will attempt to accommodate as many people as possible. However, admittance will be limited to the seating available. There will be no public oral participation, but the public may submit written comments to Thomas S. Tycz, the Committee's designated Federal Officer, before the meeting.

For additional information contact: Thomas S. Tycz, Deputy Chief, Domestic Facilities Division, Federal Communications Commission, at (202) 634-1817.

LEOAC-22

U.S. Department
of Transportation
Federal Aviation
Administration

800 Independence Ave., S.W.
Washington, D.C. 20591

August 13, 1992

Federal Communications Commission
1919 M Street, NW
Washington, D.C. 20554

Reference: Below 1 GHz LEO Negotiated Rulemaking Committee

Attention: Mr. Thomas C. Tycz

The Federal Aviation Administration (FAA) is forwarding the attached paper to the referenced committee to voice concern regarding the proposed introduction of Low Earth Orbiting (LEO) satellite system operations in a band adjacent to Very High Frequency (VHF) Aeronautical Mobile (Route) Service (AM(R)S) operations.

Mr. Carroll Sturm, the FAA committee representative, will present the paper at the working group meeting and be available to discuss the paper and answer any related questions.

Sincerely,

for Gerald J. Markey
Manager, Spectrum Engineering Division

Federal Aviation Administration
Spectrum Engineering

August 14, 1992

Consideration of LEO Satellite System Design to Ensure No Adverse Impact on VHF AM(R)S Operations

1.0 Introduction

1.1 The Federal Aviation Administration (FAA), on behalf of the United States (U.S.) civil aviation community, is presenting this paper to voice concern regarding the proposed introduction of Low Earth Orbiting (LEO) satellite system operations in a band adjacent to Very High Frequency (VHF) Aeronautical Mobile (Route) Service (AM(R)S) operations.

1.2 The AM(R)S, consisting of aeronautical safety communications, is allocated to operate in the 118-137 MHz band. One of the bands allocated for LEO satellite systems by the 1992 World Administrative Radio Conference (WARC-92), under various conditions, is 137-138 MHz. The FAA wants to ensure that there will be no impact from LEO satellite system operations on the VHF AM(R)S. In particular:

(1) the level of out-of-band spurious emissions from the LEO satellite system operations must not cause any degradation to the VHF AM(R)S, and

(2) LEO satellite system shall claim no protection from out-of-band spurious emissions in the 137-138 MHz band originating from AM(R)S operations complying with established requirements.

1.3 The FAA expects that appropriate satellite transmission characteristics and satellite system receiver (i.e., ground terminal) designs will be established to ensure that the above requirements are satisfied.

2.0 Conditions for No Degradation to AM(R)S

2.1 A look at the requirements to achieve interference-free AM(R)S communications will establish the basis for determining the noise power density levels that can be tolerated from adjacent channel operations.

2.2 The following definitions and assumptions were used in the analysis:

a. Transmitter power: nominal power out from FAA ground transmitters is 10 watts, and from airborne transmitters is 4 or 14 watts. This analysis assumes an effective isotropic radiated power (EIRP) of 7 dBW (5 watts).

b. Protection baseline requirement: an aircraft could be located 200 nautical miles from an FAA ground station. Using 200 miles for the analysis will cover all but the most unusual sectors and will result in a free space loss (FSL) of 126.5 dB at 137 MHz. An aircraft at this distance from the ground station would receive a -119.5 dBW signal within the 8 kHz receiver bandwidth. Relative to bandwidth this is -119.5 dBW/8 kHz.

c. Co-channel protection: a 14 dB desired-to-undesired signal ratio provides sufficient co-channel frequency protection for aeronautical operations in the United States [ICAO specifies 20 dB]. Thus, unwanted AM(R)S emissions in a channel must be at or below -133.5 dBW/8 kHz.

d. Protection from out-of-band emissions: out-of-band emissions potentially impacting on AM(R)S operations are expected by the FAA to be at least 10 dB below undesired AM(R)S signals. Thus, out-of-band emissions will be at or below -143.5 dBW/8 kHz.

2.3 Summarizing these factors assumed for the analysis presents:

Transmitter power (EIRP)	5 watts	+ 7.0 dBW	
200 mile FSL	137 MHz	-126.5 dB	
Co-channel protection	14 dB	- 14.0 dB	
Out-of-band emissions protection	10 dB	- 10.0 dB	
Maximum out-of-band signal level		-143.5 dBW/8 kHz	
	or	-146.5 dBW/4 kHz	

2.4 This maximum level of spurious radiation (-146.5 dBW/4 kHz) is that due to all LEO satellite transmissions. It is assumed that there could be at least 4 LEO satellites transmitting simultaneously. There, the maximum level of spurious emissions from any single satellite would be -152.5 dBW/4 kHz at the AM(R)S VHF receiver.

2.5 Assuming 0 dBI antenna gain, translates power into -148.3 dBW/M^2/4 kHz power flux density (PFD).

[since PFD = Power - (38.5 - 20 log f_{MHz})

= -152.5 - (38.5 - 20 log 137)

= -152.5 - (38.5 - 42.7)

PFD = -148.3 dBW/M^2/4 kHz]

2.6 Therefore, the out-of-band spurious of any LEO satellite into the 118 - 137 MHz AM(R)S band must not be greater than -152.5 dBW/4 kHz or -148.3 dBW/M^2/4 kHz.

3.0 Spurious Emissions from AM(R)S into 137 - 138 MHz Band.

3.1 The AM(R)S operations are safety of life related and are allowed specific out-of-band emissions. These out-of-band emissions must be considered by designers of systems operating in the LEO 137 -138 MHz band.

3.2 The Code of Federal Regulations (CFR) 47, Part 87.139(a) provides the requirements for aeronautical operations originating in the 118 - 137 MHz band. These limits for spurious emissions referenced to transmitter mean power are:

12.5 kHz < delta f < 25.0 kHz		-25 dB
25.0 kHz < delta f < 62.5 kHz		-35 dB
62.5 kHz < delta f	(for aircraft)	-40 dB
	(for ground)	-50 dB

These characteristics are also generally consistent with National Telecommunications and Information Administration (NTIA) requirements.

3.3 For this analysis, it is assumed that the EIRP of the AM(R)S transmissions will be 10 dBW, and the center frequency will be 136.975 MHz (highest assignable 25 kHz channel). The values presented in Figure 1 are for a single terminal, however, there may be a number of terminals operating simultaneously within the view of the LEO system receiver terminal, depending upon its exact location and altitude. <u>For the purposes of receiver design, it should be assumed that up to 4 AM(R)S terminals could be operating simultaneously, resulting in an out-of-band emissions increase of 6 dB over the data presented in Figure 1.</u>

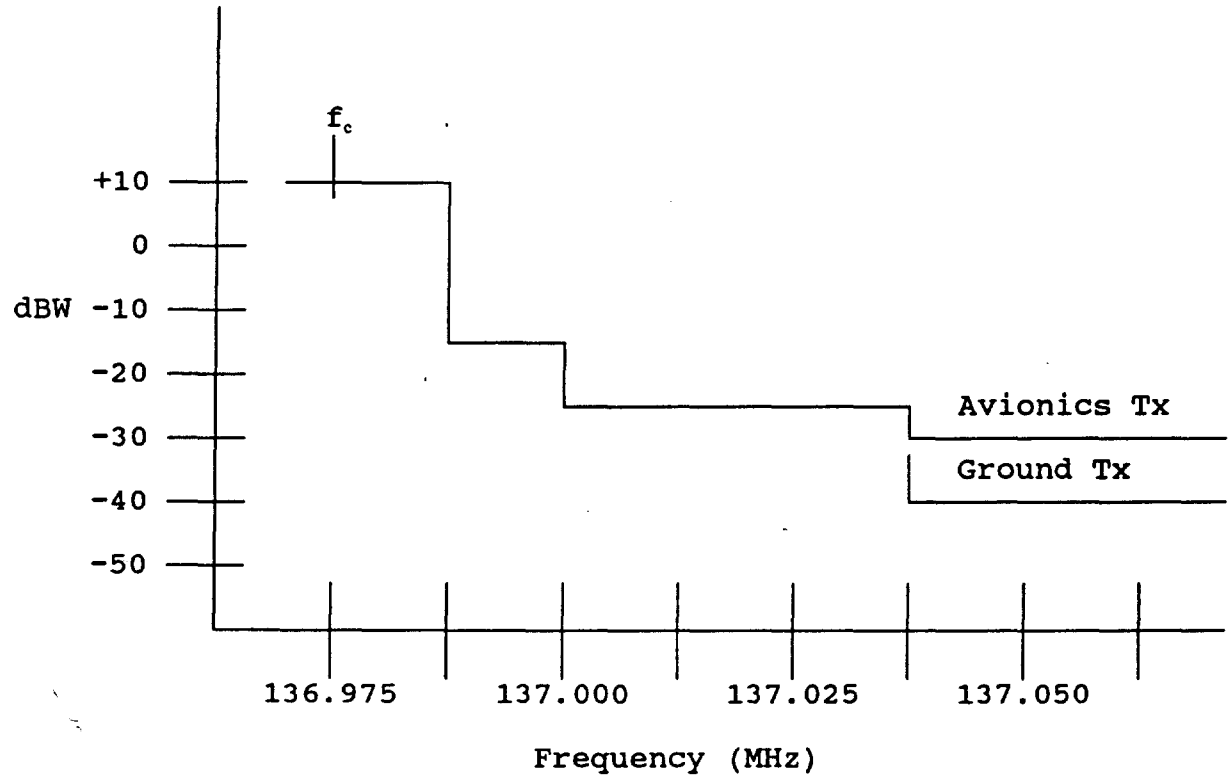


Figure 1 - FCC Part 87 - Emission Limits for a Single Avionics or Ground Transmitter (Tx) Station

LEOAC-23

INTERNATIONAL TELECOMMUNICATION UNION

INTERNATIONAL RADIO CONSULTATIVE COMMITTEE

CCIR

CCIR REPORT

TECHNICAL AND OPERATIONAL BASES FOR THE WORLD ADMINISTRATIVE RADIO CONFERENCE 1992 (WARC-92)

11.3 Frequency aspects

11.3.1 Spectrum requirements

A world-wide frequency allocation for LEO mobile satellite systems has the potential to reduce equipment costs, and facilitate systems compatibility and operational aspects.

The spectrum which may be expected to be utilized by LEO satellite systems (utilizing CDMA and FDMA modulation techniques) is given in Table XI-II, based upon studies of the capacity required to accommodate the expected traffic. However, because of the differences in modulation techniques, a direct comparison of these spectrum requirements is not feasible, without considering other factors.

TABLE XI-II

LEO MSS spectrum utilization for LEO systems

	space-to-Earth	Earth-to-space
FDMA	320 kHz	250 kHz
CDMA(1)	850 - 1 000 kHz	850 - 1 000 kHz

Note: (1) Depending on system capacity requirements, this bandwidth would typically accommodate three or four similar CDMA LEO systems.

The FDMA systems use discrete carriers for each user message. These systems are expected to utilize algorithms which will permit selection of available channels over a predetermined band; therefore they do not require that all user transmissions fill a contiguous band. The CDMA systems generally do utilize contiguous spectrum, and permit overlaying of multiple similar systems within the same spectrum.

Spectrum of the order of 1 MHz (in each direction) would permit operation of three to four LEO systems of either type if there were no other services occupying the bands of concern. Allocations less than 850 kHz (in each direction) would not accommodate the foreseen CDMA systems. Allocations of greater size (e.g. up to 5 MHz as indicated by the WARC-92 agenda) may facilitate sharing with existing services and may permit a greater number of LEO mobile-satellite systems.

The nature of the system architecture is such that the feeder links to and from the gateway terminals and the satellites use the same allocation as the user terminals (see § 11.2). There is no special requirement for feeder links for this type of LEO system within the FSS bands.

11.3.2 Preferred operating frequency

For a LEO satellite system relying on simple, low mass satellites, a wide coverage beam antenna is desired. In systems employing these satellites and using omni-directional mobile antennas, the transmitted power requirement increase as the square of the operating frequency.

Accordingly, considering propagation effects and current technology the most desirable operating frequency is in the 100 - 150 MHz band. Each paired allocation needs to have at least 7 % separation between up link and down link.

LEOAC-24

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum to the Fixed-Satellite Service and to the Mobile-Satellite Service for Low-Earth Orbit Satellites.	)	ET Docket No. 91-280

REPLY COMMENTS OF ORBITAL COMMUNICATIONS CORPORATION

Albert Halprin
Stephen L. Goodman
Verner, Liipfert, Bernhard,
McPherson & Hand
Suite 700
901 Fifteenth Street, N.W.
Washington, D.C. 20005
(202) 371-6000

Counsel for ORBITAL COMMUNICATIONS CORPORATION

Dated: January 23, 1992